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(54) **FUEL SUPPLY SYSTEM FOR A GAS BURNER ASSEMBLY**

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F24C 3/08 (2006.01)
F23N 5/18 (2006.01)

(52) **U.S. Cl.**

CPC ***F24C 3/122*** (2013.01); ***F24C 3/082*** (2013.01); ***F24C 3/085*** (2013.01); ***F24C 3/126*** (2013.01); *F23D 2208/00* (2013.01); *F23N 2005/181* (2013.01); *F23N 2005/182* (2013.01)

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CPC F24C 3/122; F24C 3/082; F24C 3/085; F24C 3/126; F24C 3/12; F24C 3/08; F23D 14/065; F23D 14/06; F23D 2205/00; F23D 2208/00; F23D 23/00; F23N 5/184; F23N 2037/02; F23N 2005/181; F23N 2005/182; F23K 5/005; F23K 5/00

USPC .... 431/285, 12, 61; 126/39 R

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,984,494 A * 12/1934 Pinkerton F24C 5/02 431/238
2,549,952 A * 4/1951 Wheelock .... F23D 14/045 236/91 R
2,594,430 A * 4/1952 Hansen 431/58
2,799,288 A * 7/1957 Knight F23D 14/60 137/98
2,916,022 A * 12/1959 Perry F23N 5/02 122/504
2,962,094 A * 11/1960 Wallace F23N 1/02 431/31
3,101,897 A * 8/1963 Vaughn .... F23N 1/027 236/1 E

(Continued)

FOREIGN PATENT DOCUMENTS

CN 1076516 A 9/1993
EP 0887590 A1 12/1998

(Continued)

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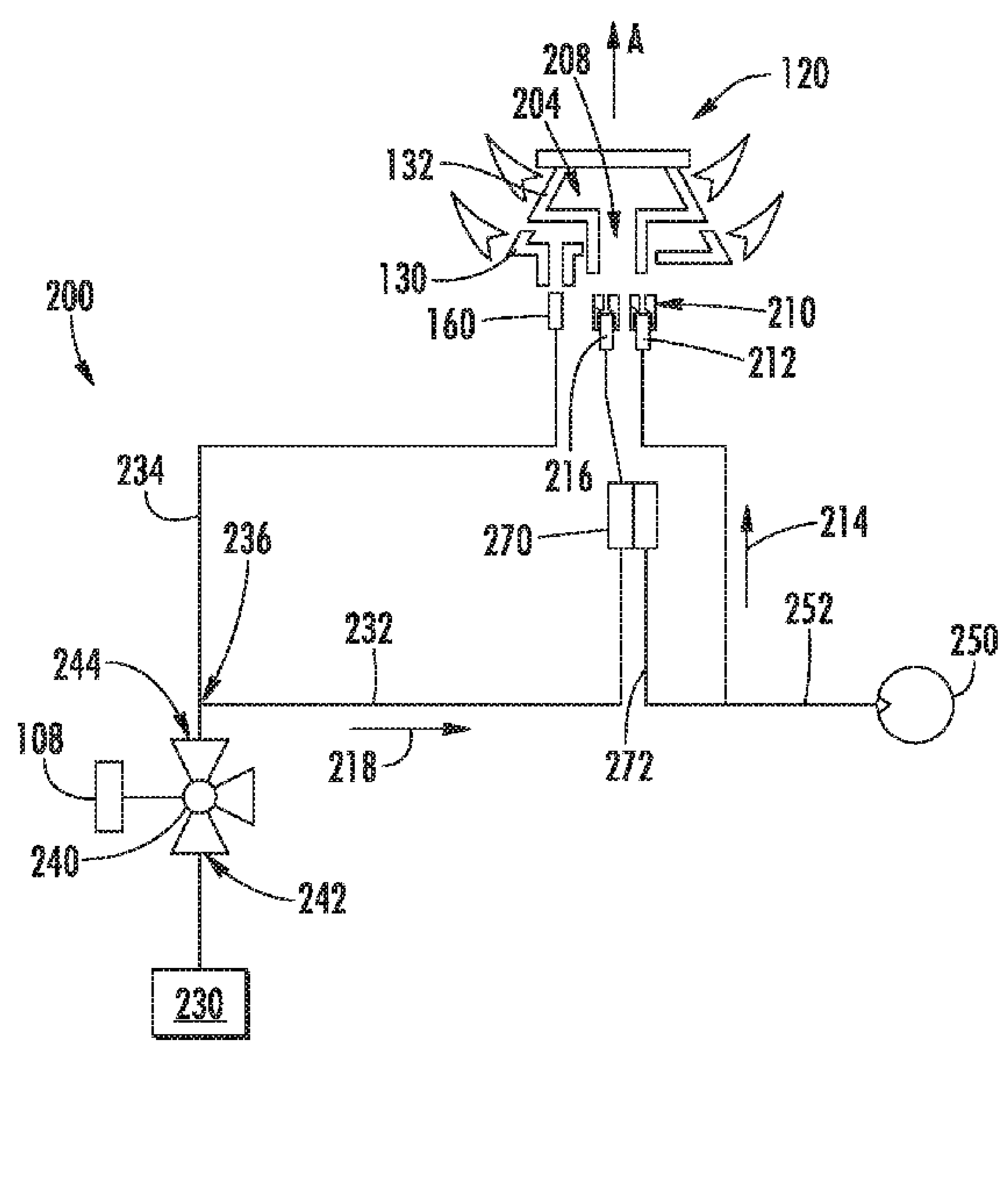
(57) **ABSTRACT**

A fuel supply system for a gas burner assembly includes a fuel supply, a forced air supply, and an injection assembly positioned proximate the gas burner assembly for providing a flow of combustion air and fuel through an inlet into a fuel chamber. A pressure controlled valve is operably coupled with the fuel supply and the forced air supply, the pressure controlled valve being configured for stopping the flow of fuel when a pressure of the flow of combustion air drops below a predetermined pressure, potentially indicating a malfunction or failure of the forced air supply.

20 Claims, 5 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

3,273,520 A * 9/1966 Hottenstine F22B 21/34 110/189
3,481,538 A * 12/1969 Dines F23N 1/025 236/24.5
3,525,325 A 8/1970 Perl
3,578,987 A * 5/1971 De Werth F12N 1/022 1/22
3,935,708 A * 2/1976 Harrewijne F02G 1/043 60/517
3,995,989 A * 12/1976 Epperson F23C 5/10 432/49
4,067,191 A * 1/1978 Gronvall F02G 1/047 60/39.27
4,424,793 A 1/1984 Cooperrider
4,992,040 A * 2/1991 Warren F23N 5/187 431/31
5,209,217 A * 5/1993 Beach .... F24C 3/126 126/21 R
5,325,842 A * 7/1994 Beach .... F24C 3/126 126/21 R
5,470,018 A * 11/1995 Smith .... F23N 1/007 126/116 A
5,509,403 A * 4/1996 Kahlke .... F24C 3/067 126/39 E
6,234,161 B1 * 5/2001 Levi .... F24C 15/006 126/19 R
6,322,354 B1 11/2001 Carbone et al.
7,901,205 B2 * 3/2011 Trochou .... F23D 14/06 126/39 E
8,402,962 B2 * 3/2013 Kim .... F23D 14/04 126/15 A
8,479,721 B2 7/2013 Graham et al.
8,747,108 B2 * 6/2014 Lona Santoyo .... F23D 14/06 126/39 B
8,823,714 B1 * 9/2014 Thielvoldt F23N 1/002 126/500
8,845,326 B2 9/2014 Shaffer et al.
8,960,234 B2 2/2015 Cadeau et al.
10,520,186 B2 * 12/2019 Langius F23N 1/025
2004/0163639 A1 * 8/2004 Kijimoto A47J 37/1242 126/374.1
2005/0142511 A1 * 6/2005 Yam F23D 14/06 431/285
2005/0221243 A1 * 10/2005 Najewicz F23D 14/04 431/18
2005/0239006 A1 * 10/2005 Specht F23D 14/04 431/12
2007/0199558 A1 * 8/2007 Kobayashi .... F24C 3/085 126/39 E
2008/0029077 A1 * 2/2008 Kobayashi .... A47J 36/34 126/39 R
2011/0143295 A1 * 6/2011 Fowler F23D 14/06 431/285
2014/0060517 A1 * 3/2014 Ren .... F23D 14/065 126/39 E
2016/0305662 A1 * 10/2016 Nakata F23N 3/002
2017/0108226 A1 * 4/2017 Moon F24C 3/022
2017/0292698 A1 * 10/2017 Langius F23N 1/022
2018/0094809 A1 * 4/2018 Lochschmied F23N 1/025
2018/0156452 A1 * 6/2018 Corti F23N 5/123
2019/0120495 A1 * 4/2019 Paller F24C 3/122
2019/0120496 A1 * 4/2019 Paller F24C 3/122
2019/0120497 A1 * 4/2019 Paller F24C 3/122
2019/0154255 A1 * 5/2019 Negretti F23N 5/203

FOREIGN PATENT DOCUMENTS

JP 52008536 A * 1/1977
JP 2000274670 A * 10/2000 .... F23N 1/022
JP 2000314510 A 11/2000
KR 100838429 B1 6/2008
WO WO-2011082924 A2 * 7/2011 .... F23D 14/34

* cited by examiner

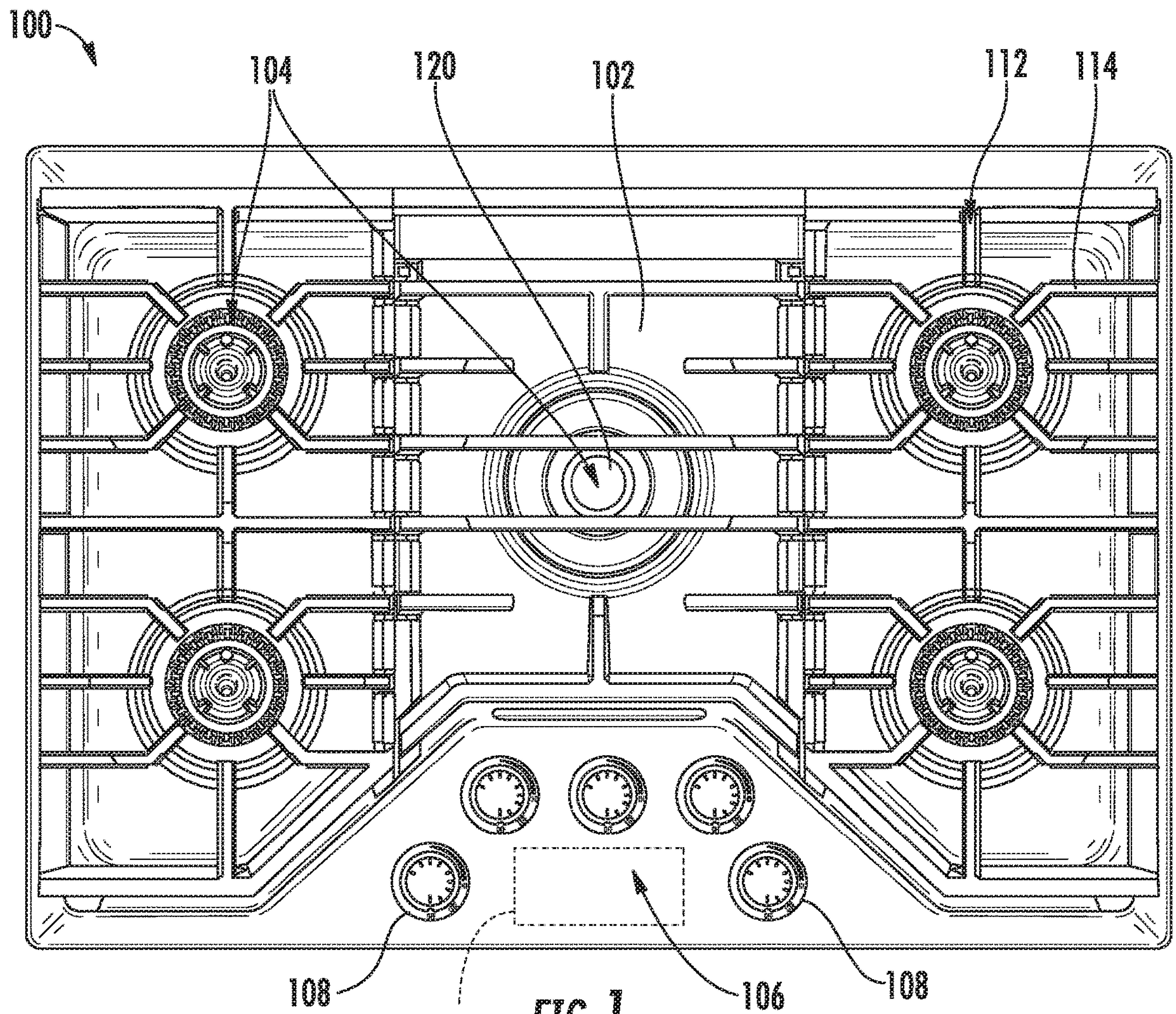


FIG. 1

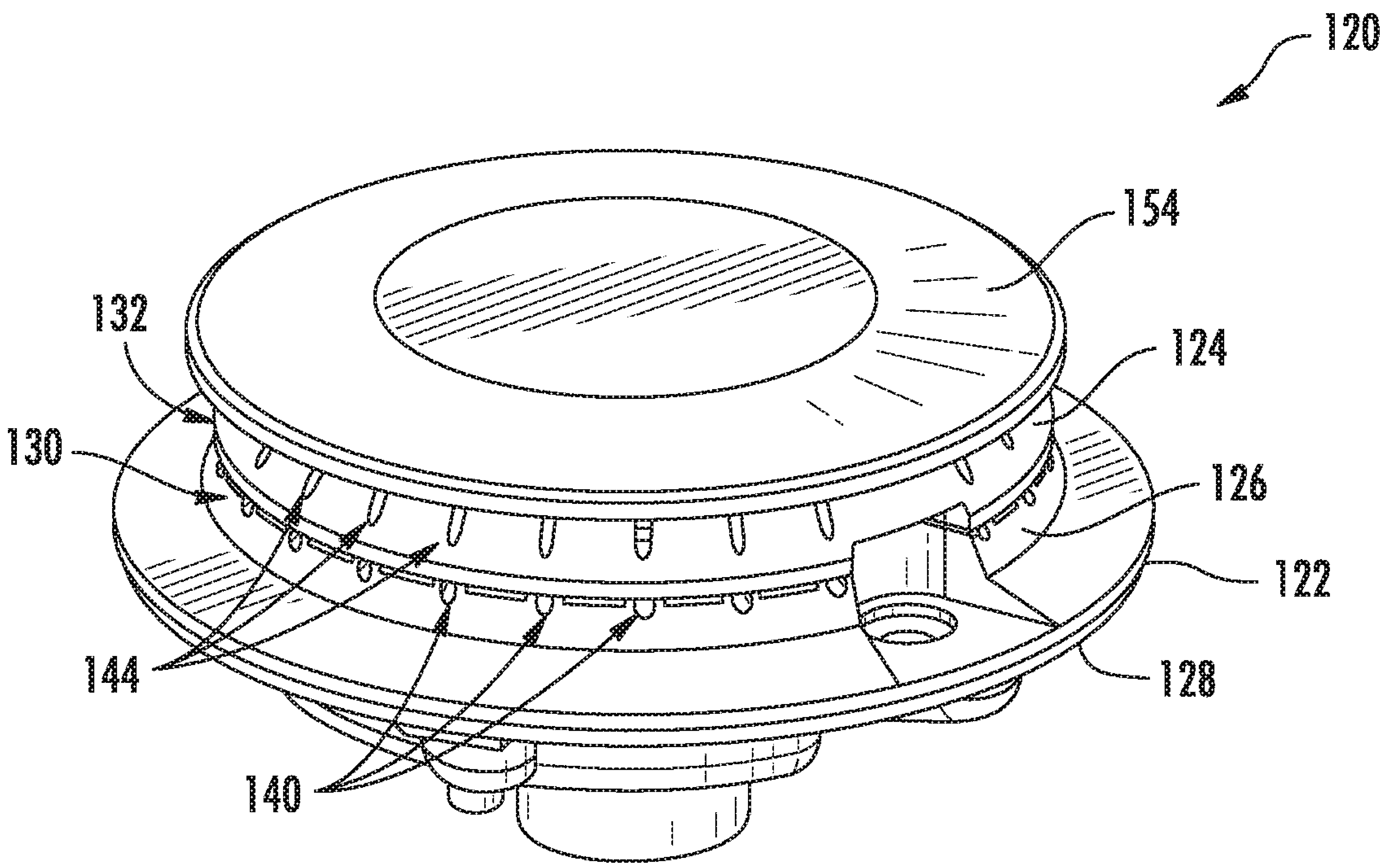


FIG. 2

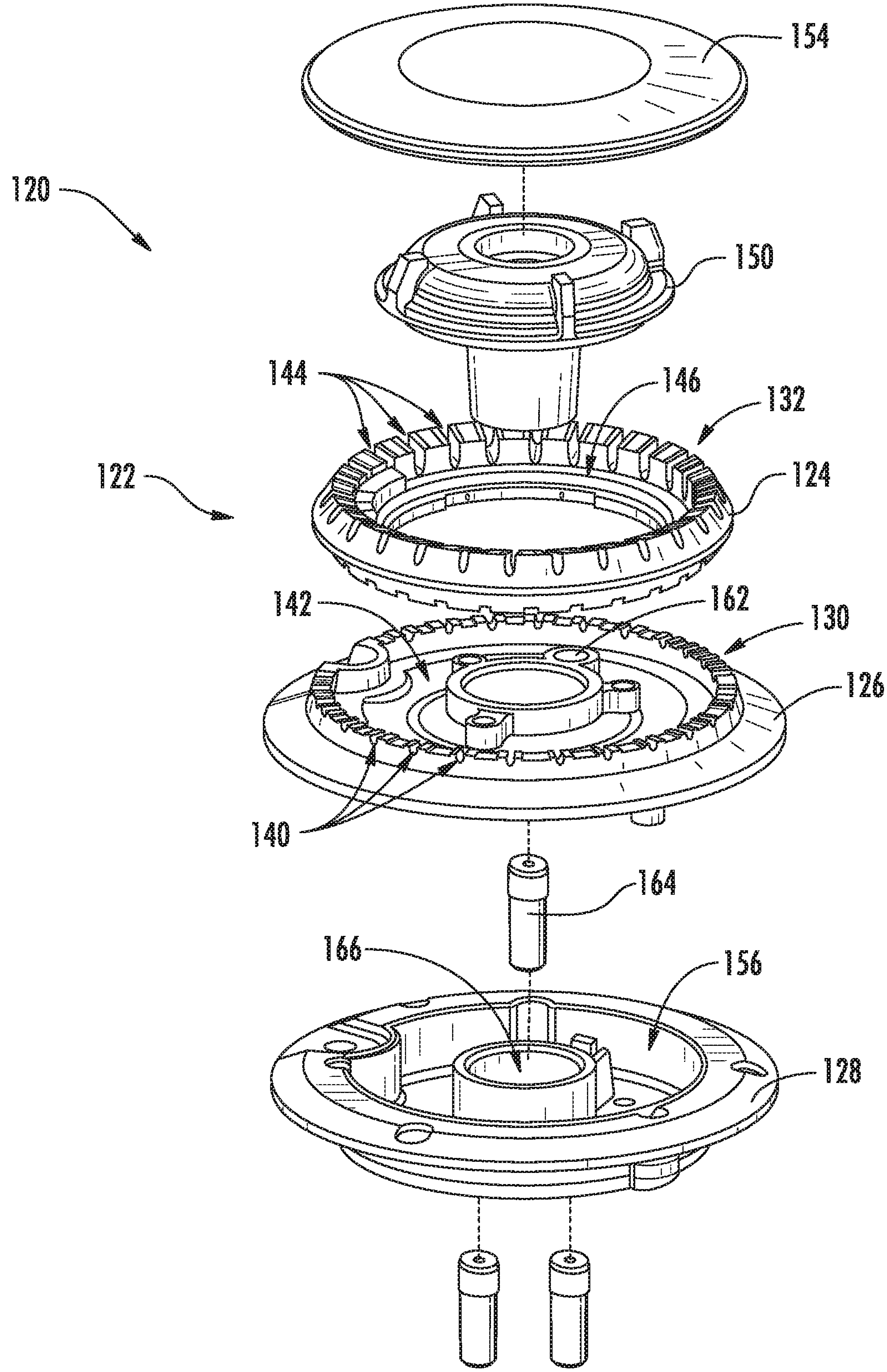

154
120
150
144
146
132
122
124
142
162
130
126
140
164
166
156
128

FIG. 3

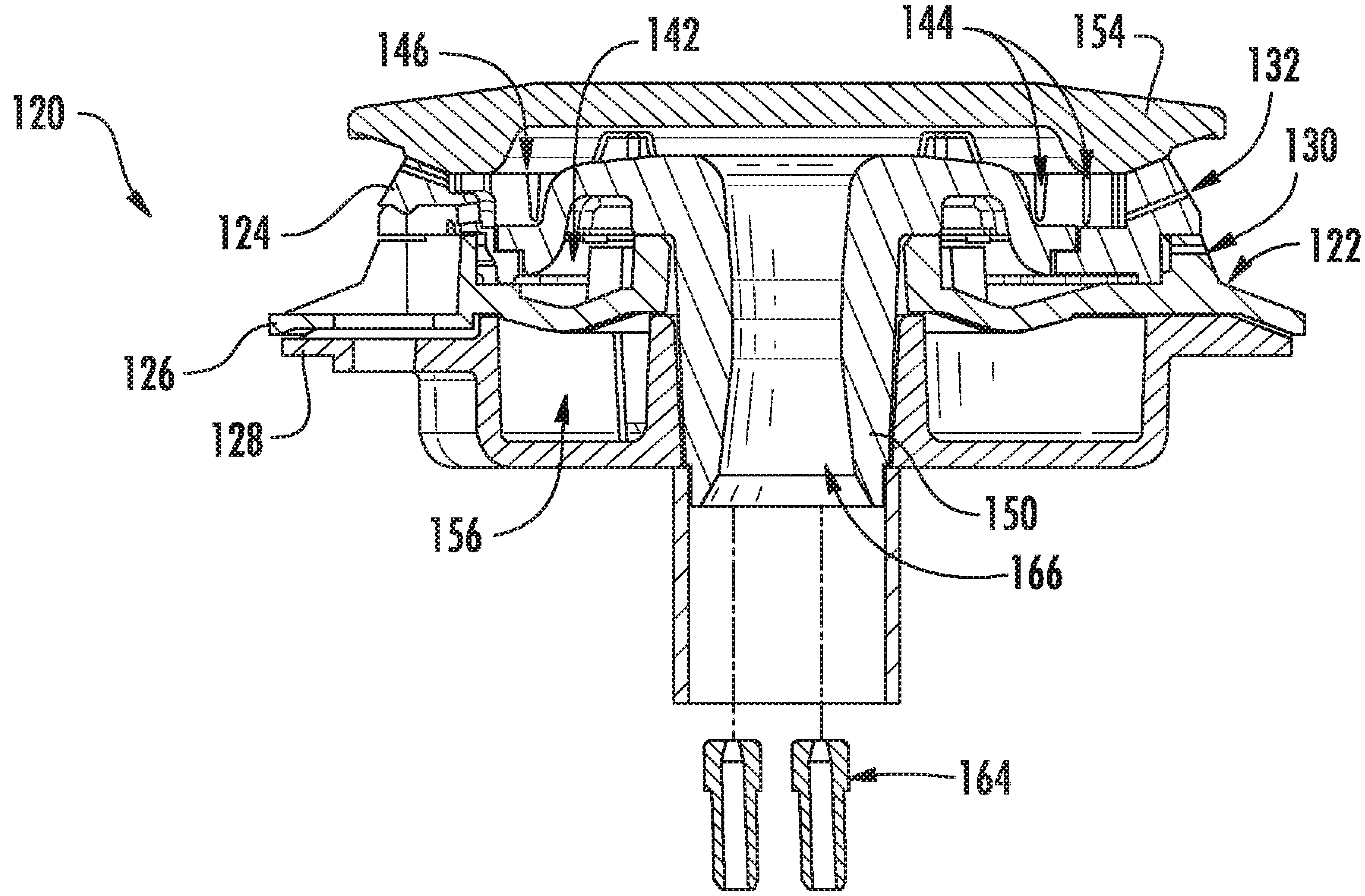
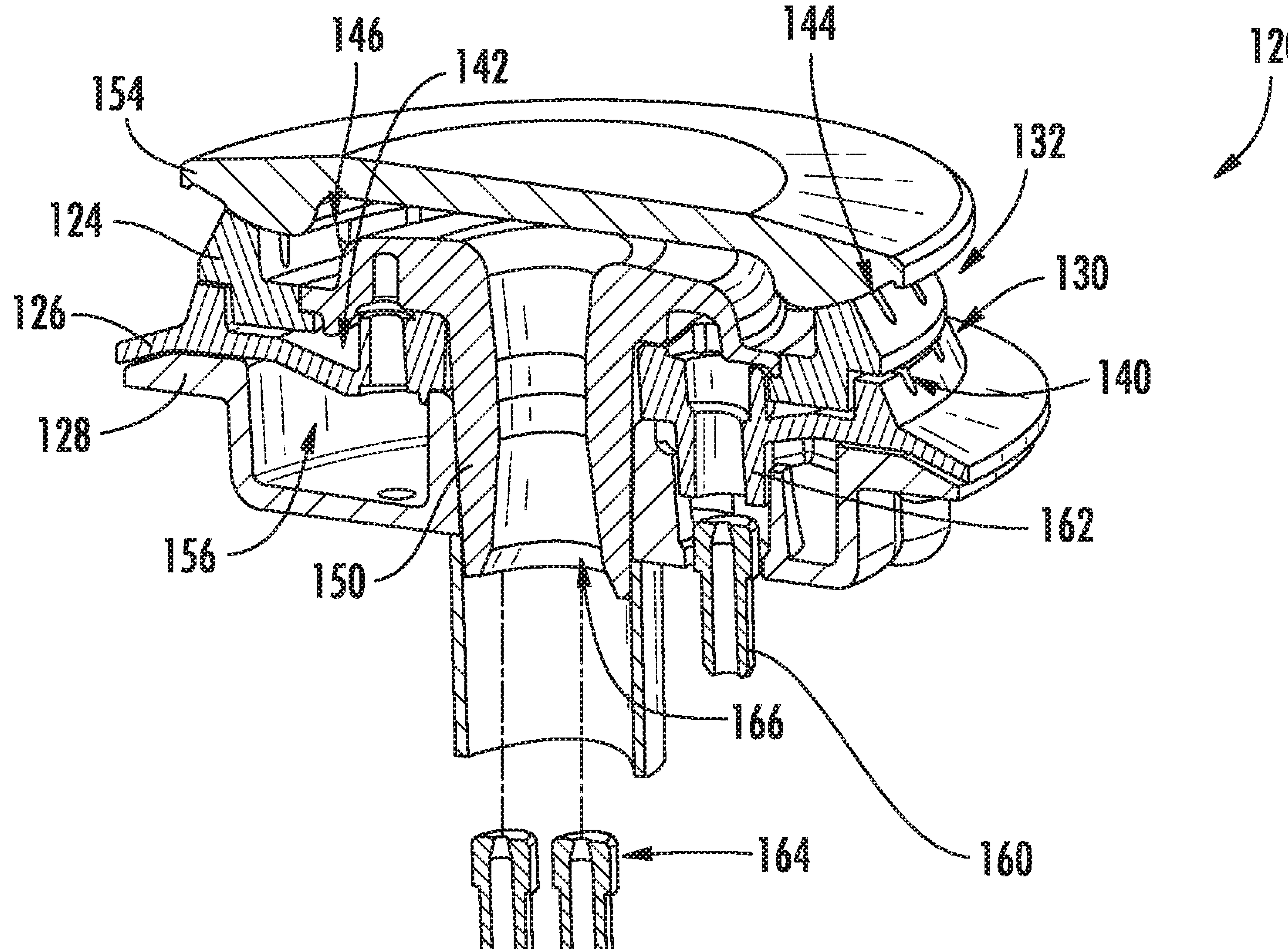

120
146
142
144
154
132
130
124
122
126
128
156
150
166
164

FIG. 4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120
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154
132
124
130
126
140
128
162
156
150
166
164
160

FIG. 5

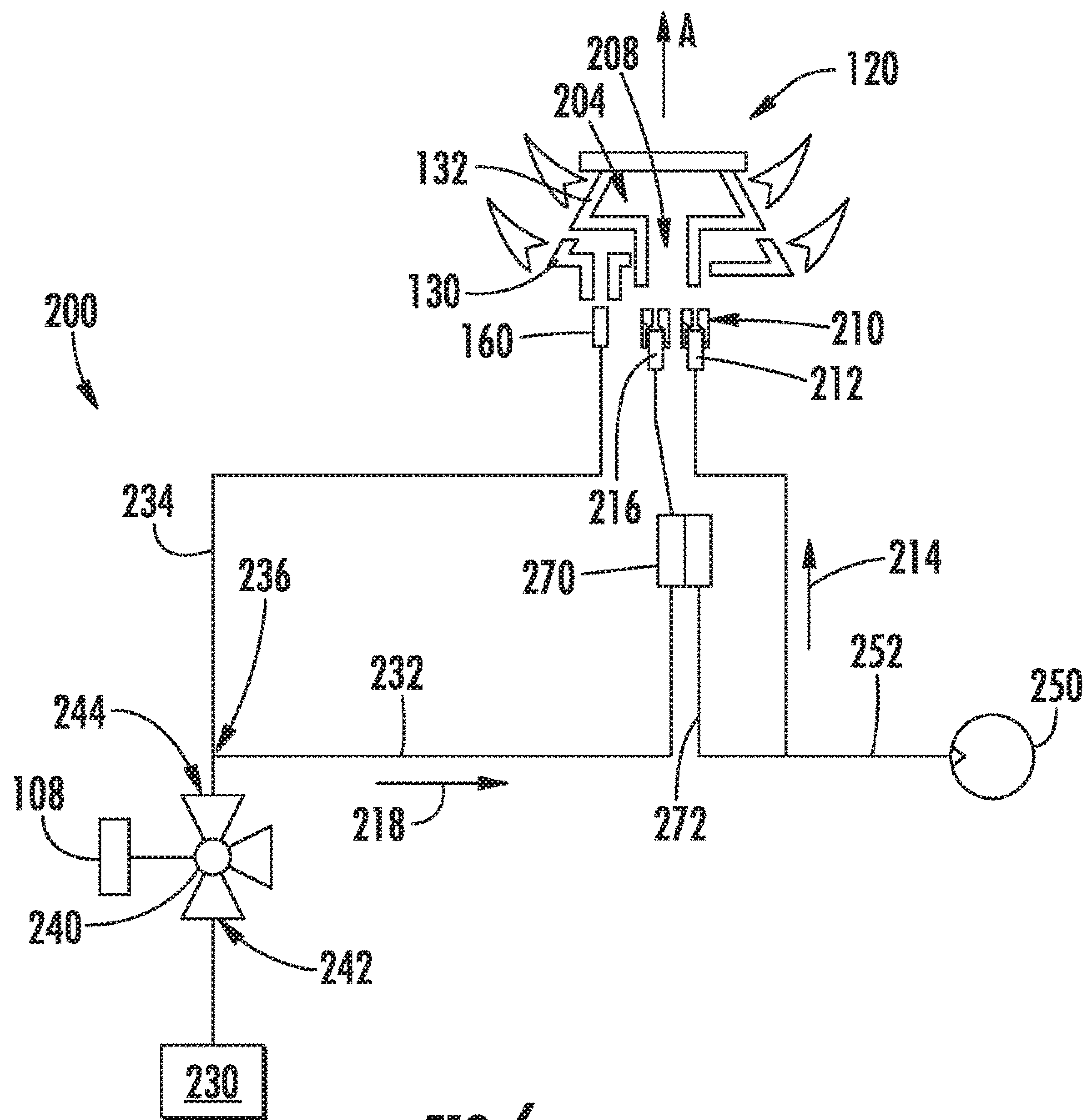
A
208
120
204
132
130
160
210
212
200
234
216
214
270
236
252
232
250
244
108
218
272
240
242
230

FIG. 6

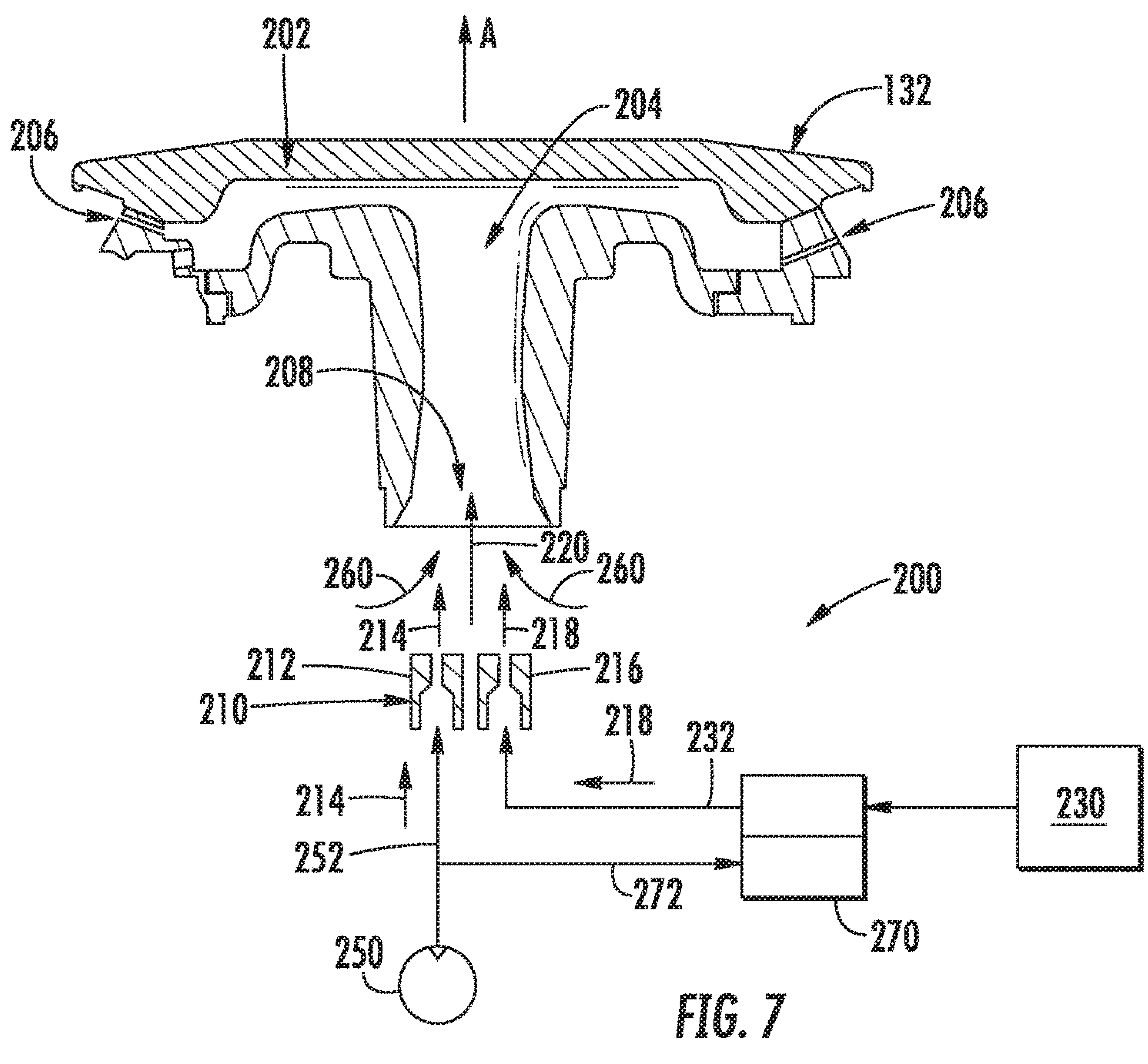
A
202
204
132
206
206
208
220
260
260
200
214
218
212
216
210
218
232
214
230
252
272
270
250

FIG. 7

FUEL SUPPLY SYSTEM FOR A GAS BURNER ASSEMBLY

FIELD OF THE INVENTION

The present subject matter relates generally to gas burner assemblies, and more particularly, to fuel supply systems for supplying a mixture of fuel and air into gas burner assemblies.

BACKGROUND OF THE INVENTION

Gas burners are commonly used on the cooktops of household gas cooking appliances including e.g., range ovens and cooktop appliances built into cabinetry. For example, gas cooktops traditionally have at least one gas burner positioned at a cooktop surface for use in heating or cooking an object, such as a cooking utensil and its contents. Gas burners generally include an orifice that directs a flow of gaseous fuel into a fuel chamber. Between the orifice and the fuel chamber, the gaseous fuel entrains air, and the gaseous fuel and air mix within the fuel chamber before being ignited and discharged out of the fuel chamber through a plurality of flame ports.

Normally aspirated gas burners rely on the energy available in the form of pressure from the fuel supplied to the gas burner to entrain air for combustion. Because the nominal fuel pressure in households is relatively low, there is a practical limit to the amount of primary air a normally aspirated gas burner can entrain. Introducing a forced air supply (such as a fan or blower) into a gas burner assembly may increase the primary air supplied into the fuel chamber in a relatively quiet and cost effective manner. However, in the event that the forced air supply fails to provide sufficient primary air for any reason, a fuel-rich mixture may be combusted in the fuel chamber, thereby increasing the risk of carbon monoxide exposure. Thus, conventional fuel supply systems including such forced air supply systems often require costly or complicated flow sensors or flow sensing schemes for regulating operation in the event of component failures.

Accordingly, a cooktop appliance including an improved gas burner assembly with improved aeration would be desirable. More particularly, a fuel supply system for a gas burner assembly that increases the flow of primary air without requiring costly and complex fail-safe mechanisms would be particularly beneficial.

BRIEF DESCRIPTION OF THE INVENTION

The present disclosure relates generally to a fuel supply system for a gas burner assembly including a fuel supply, a forced air supply, and an injection assembly positioned proximate the gas burner assembly for providing a flow of combustion air and fuel through an inlet into a fuel chamber. A pressure controlled valve is operably coupled with the fuel supply and the forced air supply, the pressure controlled valve being configured for stopping the flow of fuel when a pressure of the flow of combustion air drops below a predetermined pressure, potentially indicating a malfunction or failure of the forced air supply. Additional aspects and advantages of the invention will be set forth in part in the following description, or may be apparent from the description, or may be learned through practice of the invention.

In one exemplary embodiment, a cooktop appliance includes a top panel and a gas burner assembly positioned at the top panel. The gas burner assembly includes a burner

body defining a fuel chamber and a plurality of flame ports, the fuel chamber being in fluid communication with the plurality of flame ports. A fuel supply system includes a fuel supply for providing a flow of fuel through a fuel supply conduit and a forced air supply for providing a flow of combustion air through an air supply conduit. An injection assembly is positioned proximate an inlet of the fuel chamber, the injection assembly being in fluid communication with the fuel supply conduit for receiving the flow of fuel and the air supply conduit for receiving the flow of combustion air. A pressure controlled valve is operably coupled with the fuel supply and the forced air supply, the pressure controlled valve configured for stopping the flow of fuel when a pressure of the flow of combustion air drops below a predetermined pressure.

In another exemplary embodiment, a fuel supply system for a gas burner assembly is provided. The gas burner assembly includes a burner body defining a fuel chamber having an inlet. The fuel supply system includes a fuel supply for providing a flow of fuel through a fuel supply conduit and a forced air supply for providing a flow of combustion air through an air supply conduit. An injection assembly is positioned proximate the inlet of the fuel chamber, the injection assembly being in fluid communication with the fuel supply conduit for receiving the flow of fuel and the air supply conduit for receiving the flow of combustion air. A pressure controlled valve is operably coupled with the fuel supply and the forced air supply, the pressure controlled valve configured for stopping the flow of fuel when a pressure of the flow of combustion air drops below a predetermined pressure.

These and other features, aspects and advantages of the present invention will become better understood with reference to the following description and appended claims. The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

A full and enabling disclosure of the present invention, including the best mode thereof, directed to one of ordinary skill in the art, is set forth in the specification, which makes reference to the appended figures.

FIG. **1** provides a top view of a cooktop appliance according to an exemplary embodiment of the present subject matter.

FIG. **2** provides a perspective view of a gas burner assembly of the exemplary cooktop appliance of FIG. **1** according to an exemplary embodiment of the present subject matter.

FIG. **3** provides an exploded perspective view of the exemplary gas burner assembly of FIG. **2**.

FIG. **4** provides a cross sectional view of the exemplary gas burner assembly of FIG. **2**.

FIG. **5** provides another cross sectional view of the exemplary gas burner assembly of FIG. **2**.

FIG. **6** provides a schematic view of a fuel supply system for providing a flow of fuel to a gas burner assembly according to an example embodiment of the present subject matter.

FIG. **7** provides another schematic view of the exemplary fuel supply system and gas burner assembly of FIG. **6** according to an example embodiment of the present subject matter.

Repeat use of reference characters in the present specification and drawings is intended to represent the same or analogous features or elements of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Reference now will be made in detail to embodiments of the invention, one or more examples of which are illustrated in the drawings. Each example is provided by way of explanation of the invention, not limitation of the invention. In fact, it will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope or spirit of the invention. For instance, features illustrated or described as part of one embodiment can be used with another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers such modifications and variations as come within the scope of the appended claims and their equivalents.

The present disclosure relates generally to a gas burner assembly for a cooktop appliance **100**. Although cooktop appliance **100** is used below for the purpose of explaining the details of the present subject matter, one skilled in the art will appreciate that the present subject matter may apply to any other suitable consumer or commercial appliance. For example, the exemplary gas burner assemblies described below may be used on other types of cooking appliances, such as ranges or oven appliances. Cooktop appliance **100** is used in the discussion below only for the purpose of explanation, and such use is not intended to limit the scope of the present disclosure in any manner.

FIG. **1** illustrates an exemplary embodiment of a cooktop appliance **100** of the present disclosure. Cooktop appliance **100** may be, e.g., fitted integrally with a surface of a kitchen counter, may be configured as a slide-in cooktop unit, or may be a part of a free-standing range cooking appliance. Cooktop appliance **100** includes a top panel **102** that includes one or more heating sources, such as heating elements **104** for use in, e.g., heating or cooking. Top panel **102**, as used herein, refers to any upper surface of cooktop appliance **100** on which utensils may be heated and therefore food cooked. In general, top panel **102** may be constructed of any suitably rigid and heat resistant material capable of supporting heating elements **104**, cooking utensils, and/or other components of cooktop appliance **100**. By way of example, top panel **102** may be constructed of enameled steel, stainless steel, glass, ceramics, and combinations thereof.

According to the illustrated exemplary embodiment, a user interface panel or control panel **106** is located within convenient reach of a user of cooktop appliance **100**. For this exemplary embodiment, control panel **106** includes control knobs **108** that are each associated with one of heating elements **104**. Control knobs **108** allow the user to activate each heating element **104** and regulate the amount of heat input each heating element **104** provides to a cooking utensil located thereon, as described in more detail below. Although cooktop appliance **100** is illustrated as including control knobs **108** for controlling heating elements **104**, it should be understood that control knobs **108** and the configuration of cooktop appliance **100** shown in FIG. **1** is provided by way of example only. More specifically, control panel **106** may include various input components, such as one or more of a variety of touch-type controls, electrical, mechanical or electro-mechanical input devices including rotary dials, push buttons, and touch pads.

According to the illustrated embodiment, control knobs **108** are located within control panel **106** of cooktop appliance **100**. However, it should be appreciated that this location is used only for the purpose of explanation, and that other locations and configurations of control panel **106** and control knobs **108** are possible and within the scope of the present subject matter. Indeed, according to alternative embodiments, control knobs **108** may instead be located directly on top panel **102** or elsewhere on cooktop appliance **100**, e.g., on a backsplash, front bezel, or any other suitable surface of cooktop appliance **100**. Control panel **106** may also be provided with one or more graphical display devices, such as a digital or analog display device designed to provide operational feedback to a user.

Operation of cooktop appliance **100** is controlled by electromechanical switches or by a controller or processing device **110** (FIG. **1**) that is operatively coupled to control panel **106** for user manipulation, e.g., to control the operation of heating elements **104**. In response to user manipulation of control panel **106**, controller **110** operates the various components of cooktop appliance **100** to execute selected instructions, commands, or other features.

Controller **110** may include a memory and microprocessor, such as a general or special purpose microprocessor operable to execute programming instructions or micro-control code associated with appliance operation. The memory may represent random access memory such as DRAM, or read only memory such as ROM or FLASH. In one embodiment, the processor executes programming instructions stored in memory. The memory may be a separate component from the processor or may be included onboard within the processor. Alternatively, controller **110** may be constructed without using a microprocessor, e.g., using a combination of discrete analog and/or digital logic circuitry (such as switches, amplifiers, integrators, comparators, flip-flops, AND gates, and the like) to perform control functionality instead of relying upon software. Control panel **106** and other components of cooktop appliance **100** may be in communication with controller **110** via one or more signal lines or shared communication busses.

According to the illustrated embodiment, cooktop appliance **100** is a gas cooktop and heating elements **104** are gas burners, such as a gas burner assembly **120** described below. As illustrated, heating elements **104** are positioned within top panel **102** and have various sizes, as shown in FIG. **1**, so as to provide for the receipt of cooking utensils (i.e., pots, pans, etc.) of various sizes and configurations and to provide different heat inputs for such cooking utensils. In addition, cooktop appliance **100** may include one or more grates **112** configured to support a cooking utensil, such as a pot, pan, etc. In general, grates **112** include a plurality of elongated members **114**, e.g., formed of cast metal, such as cast iron. The cooking utensil may be placed on the elongated members **114** of each grate **112** such that the cooking utensil rests on an upper surface of elongated members **114** during the cooking process. Heating elements **104** are positioned underneath the various grates **112** such that heating elements **104** provide thermal energy to cooking utensils above top panel **102** by combustion of fuel below the cooking utensils.

FIG. **2** is a perspective view of gas burner assembly **120**. FIG. **3** is an exploded view of gas burner assembly **120**. FIGS. **4** and **5** are section views of gas burner assembly **120**. As an example, gas burner assembly **120** may be used in cooktop appliance **100** (FIG. **1**) as one of heating elements **104**. However, it will be understood that, while described in greater detail below in the context of cooktop appliance **100**, gas burner assembly **120** may be used in or with any suitable appliance in alternative example embodiments.

As may be seen in FIGS. **2** through **5**, gas burner assembly **120** includes one or more burner bodies **122**, which may include for example, a first burner body **124**, a second burner body **126**, and a third burner body **128**. Burner bodies **122** generally define a first burner ring or stage **130** (e.g., a primary burner) and a second burner ring or stage **132** (e.g., a boost burner). More specifically, first burner stage **130** generally includes a first plurality of flame ports **140** and a first fuel chamber **142** which are defined by first burner body **124** and second burner body **126**. Similarly, second burner stage **132** generally includes a second plurality of flame ports **144** and a second fuel chamber **146** which are defined at least in part by first burner body **124**.

Gas burner assembly **120** may also include an air duct **150** and a cap **154**. First plurality of flame ports **140** may be defined on second burner body **126**, e.g., at a circular outer wall of second burner body **126**. Similarly, second plurality of flame ports **144** may be defined on first burner body **124**, e.g., at a circular outer wall of first burner body **124**. Second fuel chamber **146** may be defined by inner surfaces of cap **154**, air duct **150**, and first burner body **124**. First fuel chamber **142** may be defined by inner surfaces of air duct **150**, first burner body **124**, and second burner body **126**. First fuel chamber **142** is separate or independent from second fuel chamber **146** within gas burner assembly **120**. Thus, first fuel chamber **142** is not in flow communication with second fuel chamber **146** within gas burner assembly **120**. In addition, an air chamber **156** may be defined by second burner body **126** and third burner body **128**.

As may be seen in FIGS. **2** through **4**, first plurality of flame ports **140** may be positioned concentric with second plurality of flame ports **144**. Further, first plurality of flame ports **140** (and first burner stage **130**) may be positioned below second plurality of flame ports **144** (and second burner stage **132**). Such positioning of first burner stage **130** relative to second burner stage **132** may improve combustion of gaseous fuel when both stages **130**, **132** are ignited. For example, flames at first burner stage **130** may assist with lighting gaseous fuel at second burner stage **132** due to the position of first burner stage **130** below second burner stage **132**.

According to the exemplary illustrated embodiment, first burner stage **130** is a normally aspirated burner that relies on the energy available in the form of pressure from the fuel supplied to the gas burner to entrain air for combustion. In this regard, for example, as best shown in FIGS. **3** and **5** a first orifice **160** is positioned at, e.g., directly below and/or concentric with, a Venturi inlet passage **162** on second burner body **126**. Venturi inlet passage **162** is in fluid communication with first fuel chamber **142**. Thus, gaseous fuel from first orifice **160** may flow into first fuel chamber **142** through Venturi inlet passage **162**. From first fuel chamber **142**, the mixture of gaseous fuel and air may flow through and be combusted at first plurality of flame ports **140**. Thus, first plurality of flame ports **140** are in fluid communication with first fuel chamber **142** such that the mixture of gaseous fuel and air within first fuel chamber **142** is flowable through first plurality of flame ports **140**. Venturi inlet passage **162** assists with naturally aspirating first burner stage **130**. For example, Venturi inlet passage **162** may increase a speed and/or decrease a pressure of gaseous fuel flowing from first orifice **160** such that Venturi inlet passage **162** entrains air from air chamber **156** into Venturi inlet passage **162**.

Similarly, for example, as best shown in FIGS. **3** through **5**, an injection assembly **164** is positioned at, e.g., directly below and/or concentric with, a second stage inlet passage **166** defined by third burner body **128**. Second stage inlet passage **166** is in fluid communication with second fuel chamber **146** such that gaseous fuel and combustion air from injection assembly **164** may flow into second fuel chamber **146** through second stage inlet passage **166**. From second fuel chamber **146**, the mixture of gaseous fuel and air may flow through and be combusted at second plurality of flame ports **144**. Thus, second plurality of flame ports **144** are in fluid communication with second fuel chamber **146** such that the mixture of gaseous fuel and air within second fuel chamber **146** is flowable through second plurality of flame ports **144**. Second stage inlet passage **166** may define any suitable shape or profile, e.g., similar to Venturi inlet passage **162**, to assist with naturally aspirating second burner stage **132**. An injection assembly **164** will be described in further detail below according to an exemplary embodiment of the present subject matter.

Referring now to FIGS. **6** and **7**, schematic views of gas burner assembly **120** and a fuel supply system **200** will be described according to an exemplary embodiment. For the purpose of explanation, simplified renderings of gas burner assembly **120** are illustrated in FIGS. **6** and **7**. For example, only first burner stage **130** and second burner stage **132** are illustrated in schematic form in FIG. **6**. In addition, FIG. **7** illustrates only second burner stage **132** for purposes of illustration and simplified explanation. Similar reference numerals may be used to refer to the same or analogous features throughout the figures. In addition, although fuel supply system **200** is illustrated as being used with gas burner assembly **120**, it should be appreciated that fuel supply system **200** as described herein may be used in any suitable gas burner assembly and in any suitable cooktop appliance.

In general, fuel supply system **200** is configured for selectively supplying gaseous fuel such as propane or natural gas to first burner stage **130** and second burner stage **132** to regulate the amount of heat generated by the respective stages. In particular, fuel supply system **200** regulates the output of both first and second burner stages **130**, **132** depending upon the desired output of gas burner assembly **120** selected by a user of gas burner assembly **120**, e.g., using control knob **108**. Thus, first burner stage **130** is separate or independent from second burner stage **132**, e.g., such that first burner stage **130** is not in fluid communication with second burner stage **132** within gas burner assembly **120**. In such manner, gaseous fuel within gas burner assembly **120** does not flow between first and second burner stages **130**, **132**.

As illustrated, gas burner assembly **120** may include a burner body **202** (such as burner bodies **122**) which generally defines a fuel chamber **204** (such as, for example, fuel chambers **142** or **146**) and a plurality of flame ports **206** (such as, for example, plurality of flame ports **140** or **144**). In addition, burner body **202** also defines an inlet **208** through which the mixture of fuel and air may flow into fuel chamber **204** for combustion at flame ports **206**.

Referring still to FIGS. **6** and **7**, fuel supply system **200** includes an injection assembly **210** positioned proximate inlet **208** of fuel chamber **204**. Injection assembly **210** (which may be the same as or similar to injection assembly **164**) is used herein generally to refer to any device for injecting a stream of fuel and/or air into fuel chamber **104**. For example, according to the illustrated embodiment, injection assembly **210** includes an air discharge orifice **212** that is positioned proximate inlet **208** of fuel chamber **204** for receiving a flow of combustion air (indicated by reference numeral **214**) and directing the flow of combustion air **214** through inlet **208** into fuel chamber **204**. Similarly, injection assembly **210** includes a fuel discharge orifice **216** that is positioned proximate inlet **208** of fuel chamber **204** for receiving a flow of fuel (indicated by reference numeral **218**) and directing the flow of fuel **218** through inlet **208** into fuel chamber **204**. In general, the flow of combustion air **214** and the flow of fuel **218** mix together to form a flow of aerated fuel **220** (FIG. **7**) within fuel chamber **204** for combustion.

As best illustrated in FIGS. **3** through **7**, air discharge orifice **212** and fuel discharge orifice **216** of injection assembly **210** are separate nozzles or injection ports that are positioned adjacent each other and are oriented along an axial direction A below inlet **208** of fuel chamber **204**. In this manner, injection assembly **210** is configured for directing the flow of combustion air **214** and the flow of fuel **218** directly into fuel chamber **204** where the flows may be further mixed prior to combustion. However, it should be appreciated that according to alternative embodiments, injection assembly **210** could be a single nozzle for injecting the two flows **214**, **218** through the same orifice, may have a dedicated mixing chamber to facilitate mixing prior to injection, or may have any other suitable, size, configuration, or orientation.

According to exemplary embodiments, any suitable sources of fuel and air may be coupled injection assembly **210** for providing the flow of combustion air **214** and/or the flow of fuel **218**. Examples of such fuel and air supplies are described below, but this description is not intended to limit the scope of the present subject matter.

According to the illustrated embodiment of FIGS. **6** and **7**, fuel supply system **200** may include a single fuel supply **230**, such as a natural gas supply line or a propane tank. Gaseous fuel (e.g., natural gas or propane) is flowable from the pressurized fuel supply **230** into a fuel supply conduit **232** which is fluidly coupled to fuel supply **230** for providing the flow of fuel **218**. As illustrated, a secondary fuel supply conduit **234** may be split off of fuel supply conduit **232** at a junction **236**, e.g., via a plumbing tee, wye, or any other suitable splitting device. As illustrated in FIG. **6**, according to an exemplary embodiment, secondary fuel supply conduit **234** may provide fuel for supporting operation of first burner stage **130**.

Referring again to FIG. **6**, fuel supply system **200** further includes a control valve **240** operably coupled to fuel supply conduit **232** for selectively directing a metered amount of fuel to gas burner assembly **120**. More specifically, control valve **240** includes a valve inlet **242** fluidly coupled with fuel supply **230** and a valve outlet **244** fluidly coupled with fuel supply conduit **232** for supplying gaseous fuel to injection assembly **210**, or more specifically, to fuel discharge orifice **216**. According to the exemplary embodiment, control valve **240** is operably coupled with control knob **108**. In this manner, a user of gas burner assembly **120** may control the flow of fuel **218** passing through fuel supply conduit **232**.

Referring again to FIGS. **6** and **7**, fuel supply system **200** includes a forced air supply **250** which is generally configured for providing the flow of combustion air **214** to injection assembly **210** for use as primary combustion air. In this regard, for example, fuel supply system **200** includes an air supply conduit **252** that provides fluid communication between forced air supply **250** and injection assembly **210**, or more specifically, air discharge orifice **212**. According to an exemplary embodiment, forced air supply **250** may be located remotely from gas burner assembly **120**, such as proximate control panel **106** of cooktop appliance **100**, and may be operably coupled with injection assembly **210** through air supply conduit **252**.

According to the illustrated embodiment, forced air supply **250** is a fan or an air pump, such as an axial or centrifugal fan. However, it should be appreciated that forced air supply **250** may be any other device suitable for urging a flow of combustion air, such as an air compressor or a centralized compressed air system. Forced air supply **250** may be configured for supplying the flow of combustion air **214** at any suitable pressure above atmospheric pressure, such as two times, five times, or greater than ten times atmospheric pressure.

In addition, a source entrainment air **260** may be provided between injection assembly **210** and inlet **208** of fuel chamber **204** such that the flow of aerated fuel **220** may entrain additional air (as indicated by reference numeral **260** in FIG. **7**) before entering inlet **208**. For example according to the illustrated embodiment, the space between injection assembly **210** and inlet **208** is open to ambient air or otherwise in fluid communication with and air chamber or supply such that the flow of aerated fuel **220** may entrain additional air **260** as it enters inlet **208**. The resulting flow of aerated fuel **220** may have an improved ratio of air for improved combustion generating a shorter, tighter, and more stable flame from flame ports **206**.

Forced air supply **250** may be configured for operating whenever the flow of fuel **218** is detected or may be directly coupled to control knob **108** and may operate accordingly. Other types, positions, and configurations of forced air supply **250** are possible and within the scope of the present subject matter. Notably, by using forced air supply **250** to provide the flow of combustion air **214** not only increases primary combustion air, but also increases the entrainment of air (e.g., entrainment air **260**) that is provided to fuel chamber **204**. Thus, fuel supply system **200** can provide the flow of aerated fuel **220** into gas burner assembly **120** at a higher air-to-fuel ratio for improved combustion.

Notably, it may be desirable to regulate the flow of fuel **218** in the event of a failure of forced air supply **250**, e.g., to prevent the flow of a fuel-rich mixture into fuel chamber **204**. In this regard, for example, if forced air supply **250** fails to provide the flow of combustion air **214** for any reason, e.g., a fan failure, the flow of aerated fuel **220** into fuel chamber will rely solely on the entrainment air **260** and may result in a fuel-rich mixture. The fuel-rich mixture may generate a significant amount of carbon monoxide when combusted, and the potential for carbon monoxide exposure in such systems often necessitates the use of complicated sensors, flow sensing schemes, or other failure detection mechanisms for ensuring safe operation.

Therefore, according to the illustrated embodiment, fuel supply system **200** further includes a shutoff valve **270** which is generally configured for shutting down or reducing the flow of fuel **218** in the event of a failure of forced air supply **250**. In this regard, for example, shutoff valve **270** may be operably coupled to fuel supply conduit **232** for regulating the flow of fuel **218** and fluidly coupled to forced air supply **250** through an air detection conduit **272** for sensing a pressure, flow rate, or other suitable parameter of the flow of combustion air **214**.

Shutoff valve **270** may be any suitable type of valve that senses the flow of combustion air **214** and may regulate the flow of fuel **218**. For example, according to the illustrated embodiment, shutoff valve **270** is a pressure controlled valve that is operably coupled with fuel supply **230** and forced air supply **250**, and is configured for stopping the flow of fuel

218 when a pressure of the flow of combustion air 214 drops below a predetermined pressure. The predetermined pressure may be selected by a user, may be associated with a specific condition or event, may be selected to correspond to an operating condition of fuel supply system 200, or may be determined in any other suitable manner.

According to an exemplary embodiment, the predetermined pressure is a minimum combustion air threshold pressure, i.e., the pressure generated by a properly operating forced air supply 250 for generating a flow of combustion air 214 for desired combustion. In other words, if forced air supply 250 fails to provide a flow of combustion air 214 suitable to support operation of gas burner assembly 120, shutoff valve 270 may sense the low pressure associated with the flow of combustion air 214 and stop the flow of fuel 218. For example, the predetermined pressure may be any suitable pressure above atmospheric pressure, such as two times, five times, or greater than ten times atmospheric pressure.

Notably, fuel supply system 200 described above may provide several additional advantages relative to conventional fuel supply systems for a gas burner assembly, such as gas burner assembly 120. For example, forced air supply 250 may provide primary combustion air and increase the entrainment of additional air for improved combustion. In addition, shutoff valve 270 may be used to ensure safe operation of gas burner assembly 120, e.g., by stopping the flow of fuel 218 in the event the flow of combustion air 214 drops below some predetermined suitable level. Other benefits and advantages of the present subject matter will be apparent to those skilled in the art.

This written description uses examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to practice the invention, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they include structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal languages of the claims.

What is claimed is:

1. A cooktop appliance, comprising:
- a top panel;
- a gas burner assembly positioned at the top panel, the gas burner assembly comprising a burner body defining a fuel chamber and a plurality of flame ports, the fuel chamber being in fluid communication with the plurality of flame ports; and
- a fuel supply system comprising:
  - a fuel supply for providing a flow of fuel through a fuel supply conduit;
  - a forced air supply for providing a flow of combustion air through an air supply conduit;
  - an injection assembly positioned proximate an inlet of the fuel chamber, the injection assembly being in fluid communication with the fuel supply conduit for receiving the flow of fuel and the air supply conduit for receiving the flow of combustion air; and
  - a pressure controlled valve operably coupled with the fuel supply and the forced air supply, the pressure controlled valve configured for stopping the flow of fuel when a pressure of the flow of combustion air drops below a predetermined pressure independent of a fuel pressure of the flow of fuel.

2. The cooktop appliance of claim 1, wherein the forced air supply is an air pump or an air compressor.

3. The cooktop appliance of claim 1, wherein the forced air supply is located remotely from the gas burner assembly or proximate a control panel of the cooktop appliance.

4. The cooktop appliance of claim 1, wherein the predetermined pressure is less than a minimum combustion air threshold pressure.

5. The cooktop appliance of claim 1, wherein the predetermined pressure is substantially equal to an atmospheric pressure.

6. The cooktop appliance of claim 1, wherein the injection assembly comprises:
- an air discharge orifice positioned proximate the inlet of the fuel chamber for directing the flow of combustion air into the fuel chamber; and
- a fuel discharge orifice positioned proximate the inlet of the fuel chamber for directing the flow of fuel into the fuel chamber.

7. The cooktop appliance of claim 6, wherein the fuel discharge orifice and the air discharge orifice are positioned adjacent each other and are oriented along a vertical direction below the inlet of the fuel chamber.

8. The cooktop appliance of claim 1, comprising:
- a control valve comprising a valve inlet in fluid communication with the fuel supply and a valve outlet in fluid communication with the fuel supply conduit, the control valve being configured for regulating the flow of fuel to the fuel supply conduit.

9. The cooktop appliance of claim 8, comprising a control knob operably coupled to the control valve and being rotatable for controlling the position of the control valve.

10. The cooktop appliance of claim 1, wherein a source of entrainment air is positioned between the fuel discharge orifice and the inlet of the fuel chamber such that the flow of fuel entrains additional air before entering the inlet of the fuel chamber.

11. The cooktop appliance of claim 1, wherein the fuel chamber is a first fuel chamber and the plurality of flame ports is a first plurality of flame ports, the burner body of the gas burner assembly further defining:
- a second fuel chamber in fluid communication with the fuel supply; and
- a second plurality of flame ports, the second fuel chamber being in fluid communication with the second plurality of flame ports.

12. The cooktop appliance of claim 11, wherein the first plurality of flame ports is positioned concentric with and below the second plurality of flame ports.

13. A fuel supply system for a gas burner assembly, the gas burner assembly comprising a burner body defining a fuel chamber having an inlet, the fuel supply system comprising:
- a fuel supply for providing a flow of fuel through a fuel supply conduit;
- a forced air supply for providing a flow of combustion air through an air supply conduit;
- an injection assembly positioned proximate the inlet of the fuel chamber, the injection assembly being in fluid communication with the fuel supply conduit for receiving the flow of fuel and the air supply conduit for receiving the flow of combustion air; and
- a pressure controlled valve operably coupled with the fuel supply and the forced air supply, the pressure controlled valve configured for stopping the flow of fuel when a

pressure of the flow of combustion air drops below a predetermined pressure independent of a fuel pressure of the flow of fuel.

14. The fuel supply system of claim **13**, wherein the forced air supply is an air pump or an air compressor.

15. The fuel supply system of claim **13**, wherein the forced air supply is located remotely from the gas burner assembly or proximate a control panel of a cooktop appliance.

16. The fuel supply system of claim **13**, wherein the predetermined pressure is less than a minimum combustion air threshold pressure.

17. The fuel supply system of claim **13**, wherein the predetermined pressure is substantially equal to an atmospheric pressure.

18. The fuel supply system of claim **13**, wherein the injection assembly comprises:

an air discharge orifice positioned proximate the inlet of the fuel chamber for directing the flow of combustion air into the fuel chamber; and

a fuel discharge orifice positioned proximate the inlet of the fuel chamber for directing the flow of fuel into the fuel chamber.

19. The fuel supply system of claim **18**, wherein the fuel discharge orifice and the air discharge orifice are positioned adjacent each other and are oriented along a vertical direction below the inlet of the fuel chamber.

20. The fuel supply system of claim **13**, wherein a source of entrainment air is positioned between the fuel discharge orifice and the inlet of the fuel chamber such that the flow of fuel entrains additional air before entering the inlet of the fuel chamber.

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